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Dräger medical

A Dräger and Siemens Company

Field Service Procedure

Part Number: SP00169
Rev: H
Date: 25 February 2004
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Narkomed GS PMC Procedure

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6.0 PMC PROCEDURE, NARKOMED GS

The procedures in this section shall be performed in their entirety each time a component is removed, replaced, calibrated, adjusted and during all scheduled Periodic Manufacturer's Certification (PMC) visits. A PMC Checklist form, P/N S010211 is available from Draeger Medical, Inc. and shall be completed by the Technical Service Representative each time a PMC is performed. Steps in the procedure marked with (✓) require a response at the corresponding line on the checklist form.

Space is also provided on the PMC checklist form to record the results of a vapor concentration test. Refer to the current Anesthesia Equipment & Monitoring System Service Information CD-ROM Service Procedures section for vapor concentration verification procedures.

NOTE: Test equipment listed below with an asterisk (*) requires calibration at a maximum interval of one year. Verify the dates on test equipment calibration labels. DO NOT USE any test equipment having an expired calibration date. Notify your supervisor immediately if any equipment is found to be out of calibration. In the space provided at the bottom of the PMC checklist form, record the Model and ID number of all calibrated test equipment used.

In the space provided at the bottom of the PMC checklist form, record the Model and ID number of all calibrated test equipment used. Also record the calibration due dates. Examples are: multimeter, digital pressure meter, Riken gas analyzer, safety analyzer, volumeter, trace gas analyzer, simulators.

Test Equipment Required:

-- *Electrical Safety Analyzer (Biotek 501 Pro or equivalent)
-- *Pressure Gauge with DISS Adapters (P/N 4114807 or equivalent)
-- *Flowmeter 0-250 ml min. (P/N S000081 or equivalent)
-- *Volume Meter (P/N 2212300 or equivalent)
-- *Digital Pressure Manometer (SenSym PDM 200CD or Equivalent)
-- *Riken Gas Indicator (Model 18H, or 1802D or equivalent)
-- Stop Watch
-- Test Lung (P/N 8401892)
-- AC Receptacle Circuit Tester

Materials Required:

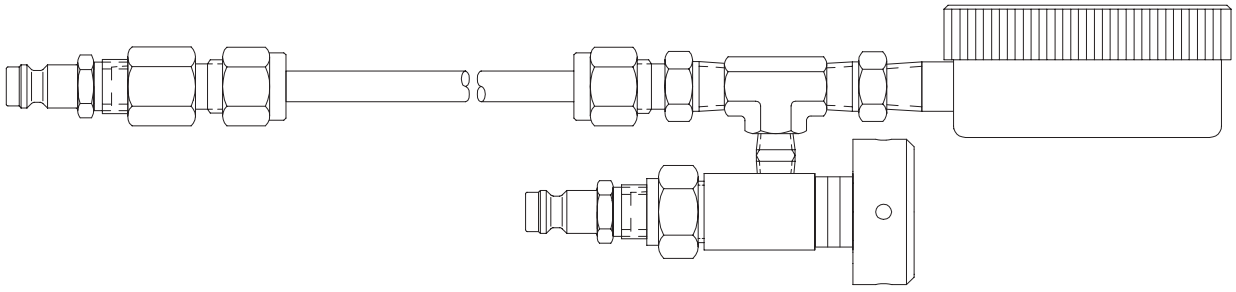
-- Spiromed Lubrication Kit (P/N 2218180)
-- Breathing Bag 3 liter (P/N 9995330 or equivalent)
-- Patient Circuit: Y-piece, elbow, 2x 32" x 22mm hoses
-- Hose 22 mm x 32" (P/N 9995132)
-- Fresh Gas Outlet Volume Test Device (P/N S010158 or equivalent)

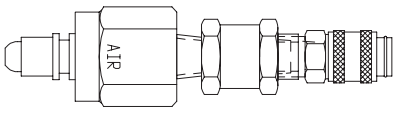
Materials Required (continued):

-- Fresh Gas Leak Test Adapter (P/N 4115041 or equivalent)
-- Volumeter/Fresh Gas Adapter (P/N 4115042)
-- Test Terminal 2x (P/N 4104389 or equivalent)
-- Breathing System Leak Test Device (P/N S010159 or equivalent)
-- PDM/Suction Adapter (P/N 4115038)
-- Scavenger Adapter (P/N 4108114)
-- NIBP w/Luer Test Adapter (P/N 4116111-001)
-- Pressure Monitor Test Adapter (P/N 4115043 or equivalent)

Key test equipment and materials illustrations are shown on following pages.

4114807 PRESSURE TEST ASSEMBLY , WITH ADAPTERS





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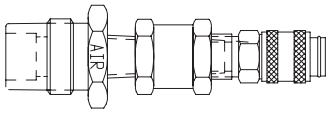

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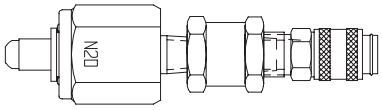

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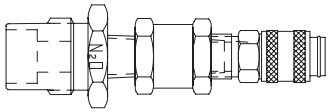

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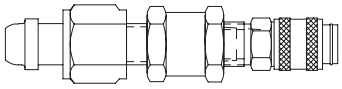

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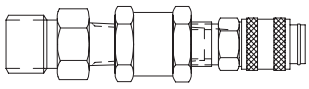
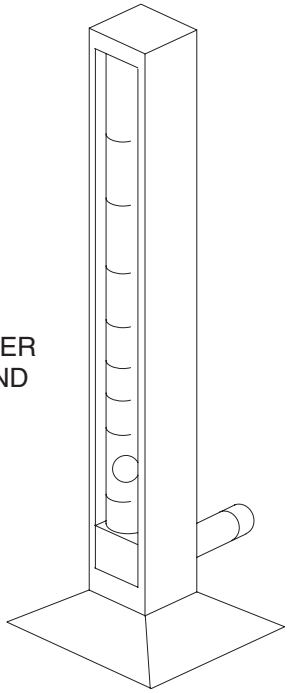


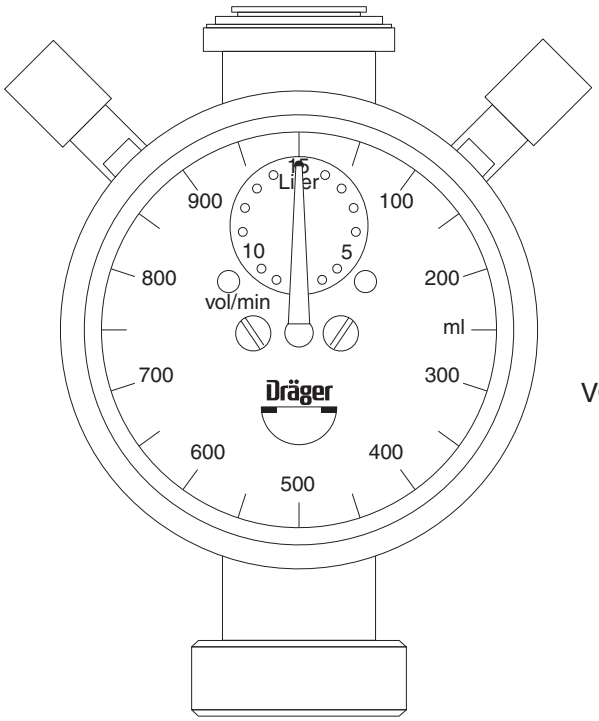
4114830-005

SP15001

PMC PROCEDURE (continued) **NMGS**

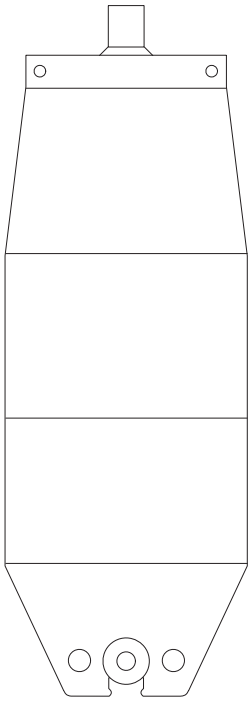
S000081
FLOW METER
TEST STAND



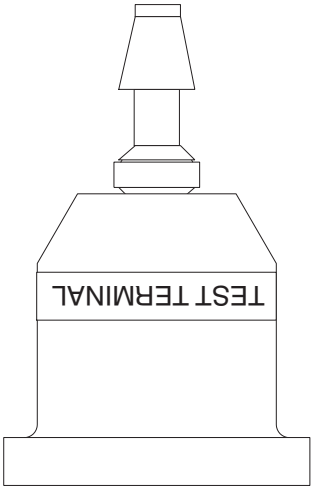


2212300
MINUTE
VOLUMETER

8401892
SIEMENS TEST LUNG



4104389
TEST TERMINAL
ADAPTER



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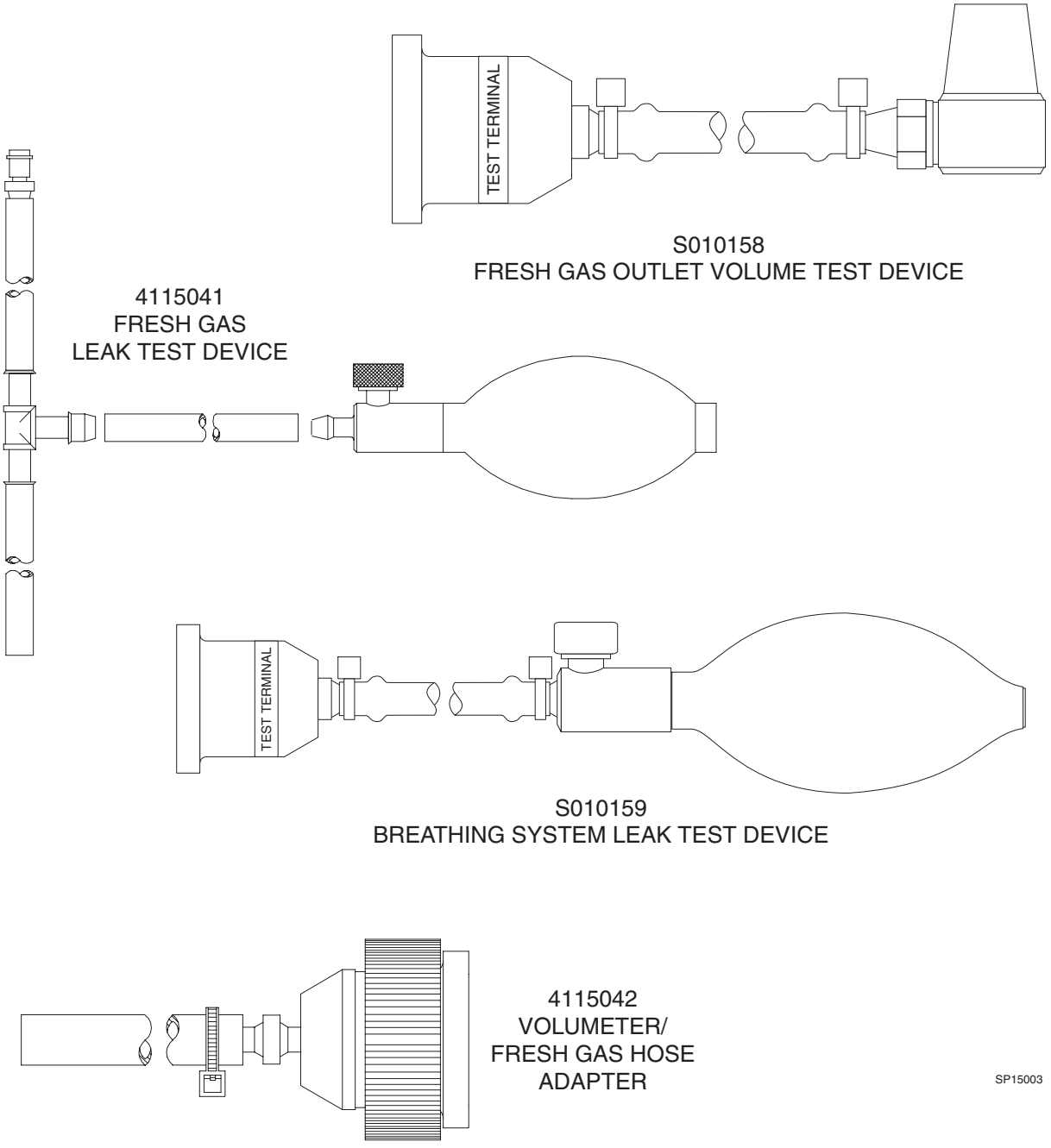
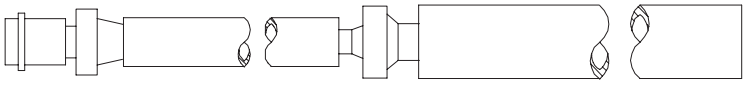
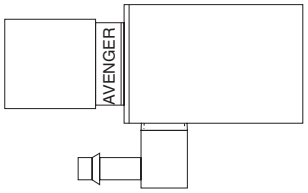
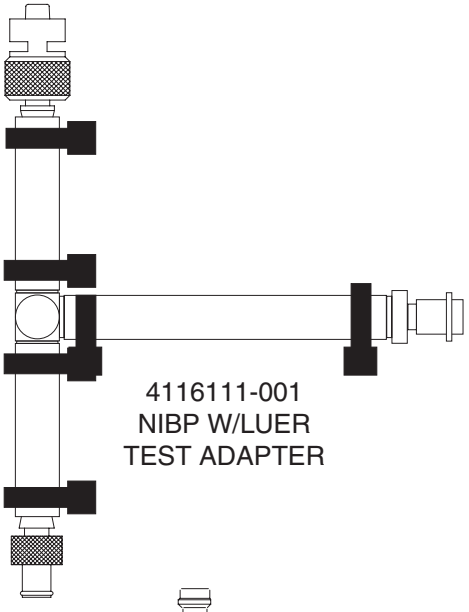

TEST TERMINAL
S010158
FRESH GAS OUTLET VOLUME TEST DEVICE
4115041
FRESH GAS
LEAK TEST DEVICE
TEST TERMINAL
S010159
BREATHING SYSTEM LEAK TEST DEVICE
4115042
VOLUMETER/
FRESH GAS HOSE
ADAPTER
SP15003



4115038
PDM TO PATIENT SUCTION ADAPTER



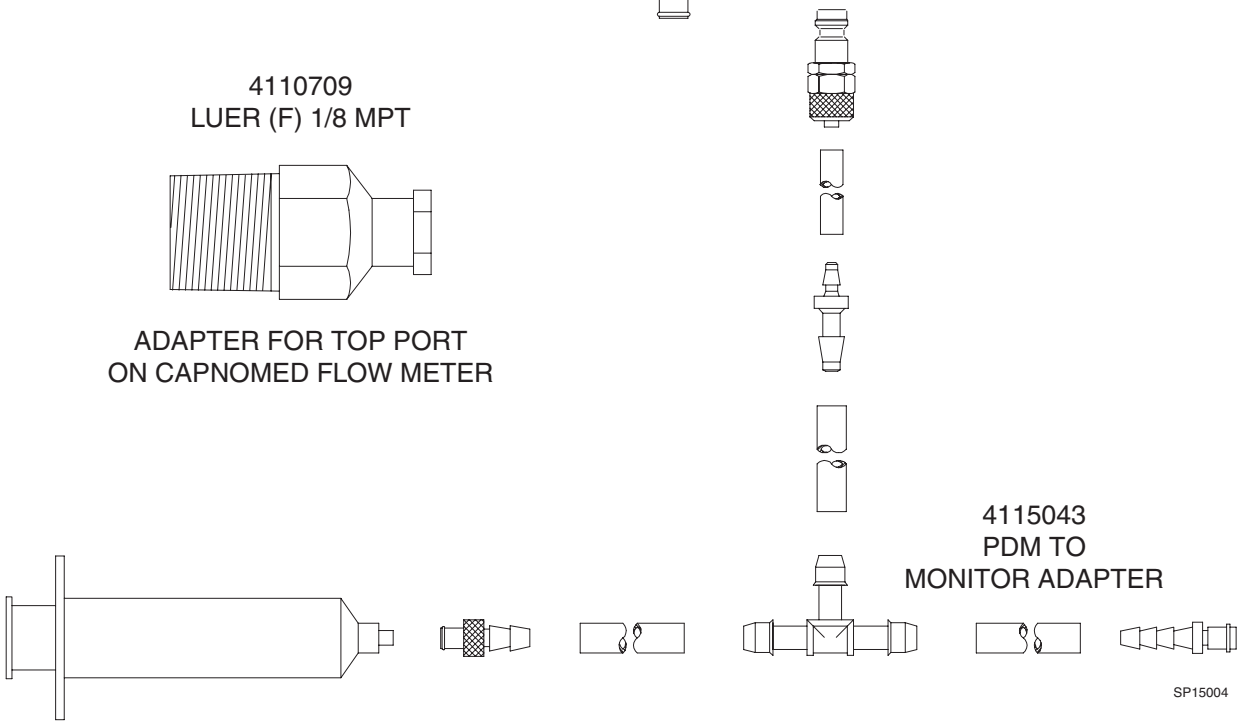
4108114
SCAVENGER ADAPTER



4116111-001
NIBP W/LUER
TEST ADAPTER

4110709
LUER (F) 1/8 MPT

ADAPTER FOR TOP PORT
ON CAPNOMED FLOW METER



4115043
PDM TO
MONITOR ADAPTER

SP15004

Periodic Manufacturer's Certification General Instructions

The purpose of this manual is to provide detailed instructions for performing a Periodic Manufacturer's Certification (PMC) inspection on a Narkomed GS Anesthesia machine.

A PMC consists of a complete Periodic Manufacturer's Service procedure and a certification level inspection based on Draeger Medical, Inc. Recommendations and equipment performance. Additional inspections are also performed to insure proper product labeling.

Several additional documents have been created to ensure the success of this new program. Following is a brief description of the purpose of each document.

Field Service Procedure:

Periodic Manufacturer's Certification Forms - Part Number SP00175. This procedure illustrates sample checklists with typical periodic maintenance items filled in, including vapor concentrations verification tests, parts replaced, general comments and certification levels. Also included are sample PMC labels marked to show several levels of certifications. An excerpt from DMI's ***Anesthesia System Risk Analysis and Risk Reduction*** is included, and also a sample of an Executive Summary to be furnished to the hospital's Risk Manager or Chief of Anesthesia.

Field Service Procedure:

DMI Recommendations Guidelines Index Anesthesia Systems - Part Number S010250. This Guideline was created to provide an assessment of each machine's certification. It contains various comprehensive overviews of possible equipment conditions and their associated certification levels.

The first list in the Recommendation Guidelines is a reference chart for machine certification based on equipment status. The second is an abbreviated summary of all DMI Recommendations and Failure Codes including the Condition Number, Equipment Condition, Recommended Corrections, Certification Code, and Tests Affected when applicable.

There is also a matrix classified as "Failure Codes" which identifies the correct manner in which to document equipment tests that fail, or were unable to be performed due to circumstances beyond the control of the service technician performing the inspection. (Ex: Air cylinder supply is unavailable to perform Air High Pressure Leak test.) The Failure Codes section also indicates suggested resolution of the situation. Failure Code numbers begin at 34 and use the same certification levels strategy, and carry the same weight as DMI Recommendation equipment condition codes.

The final matrix is the most comprehensive index sorted by machine model and includes Equipment Condition, Certification Code, and DMI Recommendations. It also specifies any suggested upgrade path including ordering information that should be taken such as installing a Bellows with Pressure Limit Control 4109664-S01 Kit, after market modification kit to a machine not equipped with pressure limit control.

The letters A, B, C, D and the Roman Numerals I, II are used as codes in the individual matrix for each model of anesthesia machine. The letters A, B, C, and D are used in descending order to indicate the certification level of the equipment. They are as follows:

A = Certified

B = Certified with Recommendations

C = Conditionally Certified

D = No Certification

Roman Numerals I and II do not affect the certification level but rather are provided to give further instructions to the end user as follows:

I = The system in its present configuration shall only be used with a CO2 monitor incorporating an apnea warning. The operator of the system is advised to frequently scan the CO2 readings and alarm thresholds.

II =The present configuration of equipment requires that the unit operate at all times with an oxygen analyzer that includes a low oxygen warning. The operator of the system is advised to frequently scan the oxygen readings and alarm limits.

Following is an explanation of machine certification levels:

Certified- No DMI Recommendations or Failure Codes apply to machine being inspected. (Only item number 33 - "No Recommendations" shall apply for this certification level.)

Certified with Recommendations- A numbered DMI Recommendation or Failure Code with a code of B applies to the machine being examined.

Conditionally Certified- A numbered DMI Recommendation or Failure Code with a code of BCI or BCII applies to the machine being examined.

No Certification- A numbered DMI Recommendation or Failure Code with a code of D applies to the machine being examined.

When multiple recommendations apply, "No Certification" would take precedence over "Conditionally Certified" and "Certified with Recommendations". "Conditionally Certified" would take precedence over "Certified with Recommendations".

For example:

A **Narkomed 2B** could have DMI Recommendation number 21 and Failure Code 61.1 that apply. 21 - No ventilator pressure limit control. Code is B. 61.1 - Enflurane agent is unavailable to test. Code is BC. Correct certification for this machine is BC, which means CONDITIONALLY CERTIFIED WITH RECOMMENDATIONS.

A **Narkomed 4** could have DMI Recommendation numbers 14 and 21 apply.
14 - CO2/Agent monitor exhaust port is not properly connected to the waste gas scavenger. Code B. 21 - No ventilator pressure limit control. Code B.
The correct certification for this machine is B, which means "CERTIFIED WITH RECOMMENDATIONS".

A **Narkomed 2B, 2C or GS** could have DMI Recommendation 30 apply. 30 - Anesthesia machine is equipped with inhalation anesthesia vaporizers without an agent analyzer in the breathing system. Code B.
The correct certification for this machine is B, which means "CERTIFIED WITH RECOMMENDATIONS".

A **Narkomed 6000** could have no DMI Recommendations or Failure Codes apply. The correct certification level for this machine is Code A, "CERTIFIED". The correct certification for this machine is A, which means "CERTIFIED".

Code, D also means "NO CERTIFICATION", also means the machine shall not receive a Periodic Manufacturer's Certification label. The machine shall receive a "WARNING - This System Is Not Certified" label, P/N 4114857. This label shall be placed at a prominent location on the right side of the machine after all other previous PM and "Vigilance Audit(r) Validation" labels have been removed.

PM Certification Procedure for Narkomed GS Anesthesia System

1. Use the PM Certification form for Narkomed 2B/ 2C/ GS Anesthesia Systems (P/N S010211).
2. Completely fill in the header information.
1. All Narkomed GS are equipped with Humphrey valves and do not require lubrication. Indicate so with a (H) next to the “Vent Valve Lube Due” line on the Periodic Manufacturer’s Certification form.
2. Replace the VENTILATOR RELIEF VALVE DIAPHRAGM every 12 months in accordance with SP00075. Place a check mark and indicate the next replacement date at “Relief Valve Diaphragm Due” line on the Periodic Manufacturer’s Certification form.
5. If machine is equipped with a HALOTHANE Dräger Vapor 19 or 19.1 vaporizer, determine if vaporizer must be inspected for soil condition one. Check the serial number plate located on the rear of the vaporizer for a plus (+) preceding the serial number. A HALOTHANE vaporizer serial number not preceded with a (+) must be tested for soil in accordance with SP00073. If vaporizer does not need to be inspected, indicate so with a plus (+) next to the “Vapor Inspection (H)” line on the Vigilance Audit form. If vaporizer is soil condition 0, indicate so with “SOIL 0” written next to the “Vapor Inspection (H)” line on the Vigilance Audit form. If vaporizer is soil condition one, indicate so with “SOIL 1” written next to the “Vapor Inspection (H)” line on the Vigilance Audit form. Place a “CAUTION DO NOT USE” label (part # 4114327) on the vaporizer, and issue a departmental alert. The TSR shall also seek permission from the equipment operator to remove the failed vaporizer from the machine and apply a replacement vaporizer or an adapter block onto the mount. All “SOIL 1” vaporizers must be removed from service for machine to receive certification.
6. Perform the vapor concentration test on all Dräger vapor vaporizers in accordance with SP00073 at a six month maximum interval. Perform the vaporizer concentration test on all Desflurane vaporizers in accordance with SP00091 for fixed mount vaporizers and SP00189 for user removable D-tec vaporizers at a six month maximum interval. For every vaporizer tested, fill out a “VAPOR VAPORIZER CALIBRATION CHECK” label (part # S010016). Information on this label shall include your signature, type of agent, date tested, a No Agent To Test or the test results @ 1%, 2.5%, 4% for H, E, I, or S vaporizers, or @ 4%, 10%, 12%, 16% for Desflurane vaporizers, and a PASS or FAIL indication. This label shall be attached to the upper right side of the vaporizer. If vaporizer fails the concentration verification, internal leak, or exclusion system tests, check “NO” in the “RECOMMENDED FOR USE” section on the PM Certification form. Place a “CAUTION DO NOT USE” label (part # 4114327) on the vaporizer, and issue a departmental alert. The TSR shall also seek permission from the customer to remove the failed vaporizer from the machine and install a replacement vaporizer or an adapter block onto the mount. All nonfunctional vaporizers must be removed from service for machine to receive certification.

7. Proceed with PM Certification procedure. If any tests fail refer to the "Failure Codes" listing in DMI Recommendations Guidelines Index (P/N S010250) to determine correct certification level starting point. Failure codes shall be documented on the "RECOMMENDATIONS / GENERAL COMMENTS" section of the PM Certification form and on the Executive Summary. If a test fails that has not been identified by the "Failure Codes" list, consult with Draeger Medical, Inc. to assess the proper certification level.

8. Based on the "EQUIPMENT CONDITION" inspect the machine for any "DMI RECOMMENDATIONS" that would apply. Use the Narkomed GS section of the "RECOMMENDATION GUIDELINES INDEX" (P/N S010250). Note all applicable DMI recommendations on the Executive Summary.

NOTE: If using a carbon form, indicate the Equipment Condition number and to see reverse side under the "RECOMMENDATIONS / GENERAL COMMENTS" section of the form.

9. Determine the correct certification level of the machine based on the combined lowest common denominator of "Equipment Conditions" and "Failure Codes". If the machine is at least conditionally certified fill out the "PM CERTIFICATION" label. Check the box(s) on the validation label where appropriate. Write the month and year, (three months from date of PM Certification) next to "NEXT VISIT DUE:". If certification level is "D", machine shall not receive a "PM CERTIFICATION" label. Any machine not receiving a PM Certification label shall receive a "WARNING NOT CERTIFIED" label, P/N **4114857**. This label shall be placed at a prominent location on the left side of the machine after all other previous PMC and Vigilance Audit Validation labels have been removed.

10. In the "CERTIFICATION LEVEL" section of the PM Certification form, record the last visit certification level, the current certification level and the next visit due month and year, (three months from date of PM Certification) in the spaces provided.

11. If applicable, remove the previous PM CERTIFICATION VALIDATION label and attach the new label (P/N S010006 w/phone #, or S010007 w/o phone #) in a prominent location on the rear of the anesthesia machine.

12. Check the appropriate boxes on the "PM CERTIFICATION NOTICE" label, (part # S010011). If the machine is not certified, the last box of this notice label shall be marked. Attach this notice near the flowmeter shield of the anesthesia machine.

13. Have the customer sign each PM Certification form or the Executive Summary, and review any Failure Codes equipment conditions and DMI Recommendations with the customer.

14. Return top copy to Draeger Medical, Inc. Service Department, keep middle copy for service organization records, give bottom copy to customer.

(✓) 6.1 SELF-DIAGNOSTICS

6.1.1 Turn the System Power switch to ON and verify the "ON" LED is lighted?

6.1.2 Verify all LED's on the keypad and ventilator displays are lit if applicable.

6.1.3 Verify that the following is displayed on the alarm CRT:

NARKOMED GS
COPYRIGHT 1996, NAD, INC.
VERSION X.XX NMGS POD
SOFTWARE ID. XXXX

FIRMWARE		**PASS**
RAM		**PASS**
VIDEO		**PASS**
A/D CONVERTER		**PASS**
AUDIO	**- PRIMARY**	**PASS**
	- BACKUP	**PASS**
SERIAL I/O		**PASS**
CLOCK		**PASS**
NON-VOLATILE MEMORY		**PASS**

FUNCTIONAL

(✓) 6.1.4 Record the machine software version on the header of the checklist form.

(✓) 6.2 ELECTRICAL SAFETY- One Year Service Interval; Due Date _____

(✓) 6.2.1 Ground Continuity

6.2.1.1 Unplug the AC power cord for all devices mounted to the machine that may provide an alternate path to earth ground, such as a Desflurane vaporizer.

6.2.1.2 Unplug the machine's AC power cord and plug the power cord of the safety analyzer into this AC receptacle.

NOTE: Do not plug the safety analyzer power cord into a line isolation monitor circuit, as inaccurate readings may occur.

NOTE: The BIOTECH 501 PRO will automatically test the source outlet for open ground (or ground resistance of 31 Ohms or higher), reverse polarity, open neutral and open line. (The latter two conditions will prevent the analyzer from powering up.)

6.2.1.3 Turn on the safety analyzer and set it's function switch to the GROUND WIRE RESISTANCE position. Attach the test lead to the red SINGLE LEAD connector of the analyzer. Connect the other end of the red test lead to the AC receptacle ground socket on the safety analyzer. Verify a displayed resistance of 0.00 ohms or, if necessary, press the CALIBRATE key on the front panel of the analyzer to zero the device.

6.2.1.4 Set the safety analyzer GROUND switch to NORMAL. Set the POLARITY switch to OFF.

6.2.1.5 Plug the machine's AC power cord into the safety analyzer.

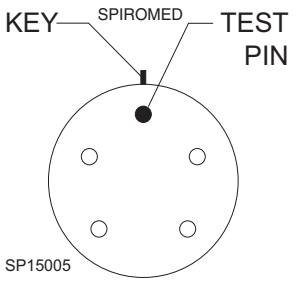
6.2.1.6 Apply the analyzer's test lead to a cylinder yoke bolt.

6.2.1.7 What is the value displayed on the safety analyzer? ___ ohm (0-0.1)

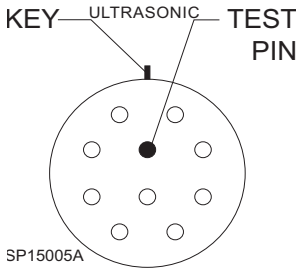
(✓) 6.2.2 Circuit Isolation

6.2.2.1 Disconnect the respiratory volume sensor cord from the interface panel.

6.2.2.2 Using a multimeter set to its highest resistance range apply the test leads between the yoke bolt and circuit common at the volume interface test pin. Refer to the corresponding illustrations for the proper test pin location. There shall be no continuity between these points.



6.2.2.3 Reconnect the respiratory volume sensor cord to the interface panel.



6.2.3 Chassis Leakage Current

6.2.3.1 Apply the analyzer test lead to a cylinder yoke bolt.

6.2.3.2 Set the safety analyzer to the CHASSIS LEAKAGE CURRENT position.

(✓) 6.2.3.3 Record the total leakage current with the Polarity and Ground switches set as follows:

Ground	Polarity
Normal	Normal
Open	Normal
Open	Reversed
Normal	Reversed

6.2.3.4 Verify that the leakage current is 100* microamps or less in each of the switch positions (110 microamps or less for the 220/240 volt power supply option).

6.2.3.5 300 microamps if external monitors are plugged into convenience receptacles.

6.2.3.6 Shut off and unplug the safety analyzer. Remove the anesthesia machine plug from the analyzer and plug it back into the original AC receptacle.

(✓) 6.2.4 Convenience Receptacle and Auxiliary Outlet Strip

NOTE: This test will check the convenience receptacle and the auxiliary strip outlets for fault conditions such as open ground, reverse polarity, open line and open neutral.

6.2.4.1 Unplug all power cords from the convenience receptacles and auxiliary outlet strip.

6.2.4.2 Plug the Receptacle Tester into the first outlet to be tested. Verify no wiring fault is indicated then remove test plug and move it to the next convenience outlet. Repeat this process until all convenience outlets and auxiliary strip outlets are tested.

6.2.4.3 Plug-in all power cords previously removed from the convenience receptacles and auxiliary outlet strip.

(✓) 6.3 CONFIGURATION

6.3.1 Press the CONFIG key.

6.3.2 The CONFIGURE screen is displayed.

6.3.3 Verify the correct Time and Date.

6.3.4 Press the exit key to exit the function.

6.4 SERVICE DATA

6.4.1 Press and hold the Oxygen High Limit key and the Volume Low Limit key, and then press the arrow up key.

6.4.2 The Main Service Screen shall appear.

6.4.3 Select and enter the Service Log.

6.4.4 Verify any pertinent information from the Service Log. Contact the Draeger Medical, Inc. Technical Service Department if necessary.

6.4.5 Press EXIT to return to the Main Service screen.

6.4.6 Select the SRVC Service Code.

6.4.7 Select and enter your Technical Service Rep. I.D. number.

(✓) 6.4.8 Press the RESET key. This resets the last service date to the current date and resets the hours run since last service to zero.

6.4.9 Press the PMS SCHED key.

(✓) 6.4.10 Select and enter the month of the next service due date and record this information on the report. The internal clock of the machine limits the amount of date advance to a maximum of six months from the current service date.

6.4.11 Press the exit key to return the main service screen, If not performing monitor calibrations press the exit key again to return to normal operation mode.

(✓) 6.5 CALIBRATIONS - One Year Service Interval; Due Date _____

6.5.1 To bring up the Oxygen Monitor Service Screen, press the Mon Cal key.

6.5.2 Remove the Oxygen sensor from the valve dome adapter, and remove the Oxygen sensor capsule from the Oxygen sensor housing.

(✓) 6.5.3 When the CURRENT CELL A and CURRENT CELL B readings have stabilized, press the ZERO key and verify that the new offset values are stored.

NOTE: The higher the offset, the higher the calculated O2 concentration appears at high concentrations.

6.5.4 Put the Oxygen sensor capsule into the Oxygen sensor housing.

6.5.5 Press the PRESS MON key.

6.5.6 Disconnect the Pressure monitor's sensor line from the absorber and expose it to ambient air.

6.5.7 Let the Current Pressure Value stabilize and press the ZERO key to store the value.

6.5.8 Connect a Pressure monitor adapter, (P/N 4115043) and calibrated digital pressure manometer to the breathing pressure sensor line.

6.5.9 Pressurize the circuit to 50 cm H_2O and allow the Current Value to stabilize.

(✓) 6.5.10 Press the SPAN key and verify that the new span values are stored.

6.5.11 Release the pressure, disconnect the manometer and test fixture, and reconnect the breathing pressure sensor line to the absorber.

6.5.12 Press EXIT to return to the Main Service screen.

6.5.13 Press EXIT to return to normal operation.

(✓) 6.6 ABSORBER MAINTENANCE

6.6.1 Remove the O_2 sensor or the plug from the inspiratory valve dome adapter and examine the O-rings on each assembly. Replace O-rings as necessary.

6.6.2 Remove the inspiratory and the expiratory valve domes.

6.6.3 Are all pins on the valve crater undamaged? Inspiratory ___ (Y) Expiratory ___ (Y)

6.6.4 Are all pins on the valve domes undamaged? Inspiratory ___ (Y) Expiratory ___ (Y)

6.6.5 Is the valve disc in good condition? Inspiratory ___ (Y) Expiratory ___ (Y)

6.6.6 Are the valve dome washers in good condition? ___ (Y)

6.6.7 Reinstall the inspiratory and expiratory valve domes.

6.6.8 Ultrasonic Flow Sensor - If applicable

6.6.8.1 Remove the Ultrasonic Flow Sensor connector hose.

6.6.8.2 Is the connector hose, connector, and O-ring in good condition? ___ (Y)

6.6.8.3 Remove the expiratory valve.

6.6.8.4 Is the washer under the valve in good condition? ___ (Y)

6.6.8.5 Reattach the expiratory valve.

6.6.8.6 Remove the ultrasonic flow sensor from the mounting bracket.

6.6.8.7 Remove the flow housing/transducer assembly from the electronics housing.

6.6.8.8 Remove both transducers from the flow housing; examine each O-ring and condition of all components, then reassemble the ultrasonic flow sensor.

6.6.8.9 Reattach the ultrasonic flow sensor to the mounting bracket.

6.6.8.10 Reattach the connector hose between the sensor and expiratory valve.

6.6.9. Lubrication, Spiromed Sensor - If applicable

6.6.9.1 Remove the expiratory valve.

6.6.9.2 Is the washer under the valve in good condition? ___ (Y)

6.6.9.3 Remove the Spiromed sensor.

6.6.9.4 Is the washer under the sensor in good condition? ___ (Y)

6.6.9.5 Locate the four lateral holes at the sides of the Spiromed sensor marked by arrows.

CAUTION: Use only Sensor Lubrication Kit P/N 2218180 for the following procedure.

6.6.9.6 Dip the tip of the pipette into the lubricant and draw lubricant into the pipette by pulling the pin backwards.

6.6.9.7 Insert the pipette into one of the four holes as far as it will go. Push the pin forward to its stop and inject lubricant into the hole.

6.6.9.8 Repeat the previous 2 steps for the lubricating three remaining holes.

6.6.9.9 Wipe any lubricant residue from the exterior of the sensor.

6.6.9.10 Reattach the sensor to the absorber top dome.

6.6.9.11 Reattach the expiratory valve to spiromed sensor.

6.6.10. Remove the inspiratory valve assembly.

6.6.11. Is the washer under the valve in good condition? ___ (Y)

6.6.12 Reinstall the inspiratory valve.

6.6.13 Are there two (2) spring clips on the absorber rods? ___ (Y)

6.6.14 Inspect the following: canisters, canister gaskets, dust cup and O-ring, and soda lime.

6.6.15 Are the canisters, canister gaskets, dust cup and O-ring, and soda lime in good condition? ___ (Y)

6.6.16 Verify the cm H_2O gauge at zero (0) and readjust if necessary.

NOTE: The small slotted screw is the zero adjust.

6.6.17 Reinstall the O_2 sensor plug into the inspiratory valve dome adapter.

6.6.18 Remove the 15-mm connector from the FRESHGAS OUTLET.

6.6.19 Is the Freshgas Outlet assembly in good condition? ___ (Y)

6.6.20 Reconnect the 15-mm connector to the FRESHGAS OUTLET.

(✓) 6.7 HIGH PRESSURE LEAK

NOTE: Minimum cylinder pressures required for High Pressure Leak tests are:
O_2, Air, O_2-HE, N_2, HE: 1000 psi / N_2O, CO_2: 600 psi;

6.7.1 Turn the machine main switch to Standby.

6.7.2 Verify the Auxiliary Oxygen flow control valve is closed.

6.7.3 Disconnect all pipeline supply hoses at the wall outlets.

6.7.4 Open then close and remove each cylinder and if applicable remove the yoke plug from each additional yoke assembly.

6.7.5 Note the reading on each the cylinder pressure gauge and start a stop watch.

6.7.6 Are the two (2) yoke index pins installed securely in each yoke? ___(Y)

6.7.7 Is the proper gas I.D. label affixed to each yoke? ___ (Y)

6.7.8 After two (2) minutes, is the pressure loss for each gas equal or less than 50 psi? ___(Y)

6.7.9 Verify the presence of only one (1) cylinder washer, then reattach and secure the cylinders to each yoke assembly, then open each cylinder valve.

6.8 BREATHING SYSTEM

6.8.1 Breathing System Leak/Exclusion

6.8.1.1 Close all flow control valves.

6.8.1.2 Set the AUTO/MAN selector to BAG.

6.8.1.3 Close the APL valve.

6.8.1.4 Interconnect a 22 mm hose (P/N 9995132) between the inspiratory valve and expiratory valve or expiratory port on the ultrasonic flow sensor, if applicable.

6.8.1.5 Attach a test terminal (P/N 4104389) to the Fresh Gas Leak Test Adapter (P/N 4115041) then attach the test terminal to the bag mount.

6.8.1.6 Apply 50 cm H_2O test pressure to the absorber system and start a stop watch.

6.8.1.7 Is the pressure on the absorber pressure gauge within 47 to 53 cm H_2O? ___(Y)

(✓) 6.8.1.8 After thirty (30) seconds, is the breathing system test pressure equal or greater than 40 cm H_2O? ___ (Y)

6.8.1.9 If applicable, turn on the left mounted vaporizer to the first graduated marking. Reapply 50 cm H_2O of pressure to the system and start a stopwatch. Is it possible to turn on either the center or right vapors? ___ (N)

(✓) 6.8.1.10 After thirty (30) seconds, is the left vaporizer test pressure equal or greater than 40 cm H_2O? ___(Y) Turn off the left vaporizer.

6.8.1.11 If applicable, turn on the center mounted vaporizer to the first graduated marking. Reapply 50 cm H_2O of pressure to the system and start a stopwatch. Is it possible to turn on either the left or right vapors? ___ (N)

(✓) 6.8.1.12 After thirty (30) seconds, is the center vaporizer test pressure equal or greater than 40 cm H_2O? ___(Y) Turn off the center mounted vaporizer.

6.8.1.13 If applicable, turn on the right mounted vaporizer to the first graduated marking. Reapply 50 cm H_2O of pressure to the system and start a stopwatch. Is it possible to turn on either the left or center vapors? ___ (N)

(✓) 6.8.1.14 After thirty (30) seconds, is the right vaporizer test pressure equal or greater than 40 cm H_2O? ___ (Y) Turn off the right mounted vaporizer.

(✓) 6.8.1.15 Did all vaporizer exclusion verifications test positive? ___ (Y)

6.8.2 APL Valve

6.8.2.1 Open the APL valve to its stop.

6.8.2.2 Turn the System Power switch to ON.

6.8.2.3 Set the Oxygen flow to 8 l/min.

(✓) 6.8.2.4 Is the pressure within 0 to 3 cm H_2O? ___ (Y)

6.8.3 O_2 Flush

6.8.3.1 Attach a 33 mm x 22 Female Adapter (P/N 4115087) to the top port of the test volumeter.

6.8.3.2 Disconnect the hose from the expiratory valve or expiratory hose terminal on the ultrasonic flow sensor, if applicable and attach it to the test volumeter adapter.

6.8.3.3 Close the APL valve.

6.8.3.4 Press and hold the O2 FLUSH button for 6 seconds; multiply the value obtained by 10.

(✓) 6.8.3.5 Is the calculated O2 flush flow rate 45 to 65 l/min.? ___ (Y)

6.8.3.6 After releasing the flush, does the flow of Oxygen stop immediately? __ (Y)

6.8.3.7 Remove the test equipment.

6.8.4 Expiratory Valve Leak

6.8.4.1 Connect a 22 mm hose (P/N 9995132) between the inspiration valve and the bag mount.

6.8.4.2 Connect a test terminal (P/N 4104389) to the expiration valve or expiratory hose terminal on the ultrasonic flow sensor, if applicable.

6.8.4.3 Connect a 0-250 ml/min. flowmeter (S000081) to the test terminal.

6.8.4.4 Turn up the Oxygen flow until the system pressurizes to 30 cm H2O. Adjust the APL valve as necessary to maintain 30 cm H2O.

(✓) 6.8.4.5 Is the value indicated on the flowmeter within 0 to 60 ml/min.? ___ (Y)

6.8.4.6 Close APL valve.

6.8.4.7 Remove all test equipment.

6.8.5 Inspiration Valve Leak

6.8.5.1 Turn the System Power switch to Standby.

6.8.5.2 Connect a test terminal (P/N 4104389) to the inspiratory valve.

6.8.5.3 Connect a Fresh Gas Leak Adapter (P/N 4115041) and calibrated pressure meter to the test terminal on the inspiratory valve.

6.8.5.4 Connect another test terminal to the bag connector.

6.8.5.5 Connect a 0-250 ml/min. flowmeter (S000081) to the test terminal on the bag mount.

6.8.5.6 Pressurize the test circuit to 30 cm H2O.

(✓) 6.8.5.7 Is the value indicated on the flowmeter within 0 to 60 ml/min.? ___ (Y)

6.8.5.8 Turn the system power switch to ON.

6.8.5.9 Remove all test equipment.

6.8.6 PEEP Valve w/Bypass - If applicable

6.8.6.1 Open the APL valve.

6.8.6.2 Interconnect the inspiratory valve and expiratory valve or expiratory port on the ultrasonic flow sensor, if applicable with a 22 mm hose (P/N 9995132).

6.8.6.3 Attach a Breathing System Leak Test Adapter (P/N S010159) to the bag mount.

6.8.6.4 Disconnect the pressure pilot line from the absorber and replace it with a PDM To Monitor Adapter (P/N 4115041).

6.8.6.5 Connect a test gauge to the adapter.

6.8.6.6 Set the O_2 flow to 5 l/min.

6.8.6.7 * Place the PEEP bypass in the ON position.

6.8.6.8 Adjust the absorber PEEP valve clockwise to the maximum position.

6.8.6.9 Does the PEEP valve adjust smoothly? ___ (Y)

(✓) 6.8.6.10 Is the maximum PEEP indicated on the test gauge within 15 to 22 cm H_2O? ___ (Y)

6.8.6.11 * Place the PEEP bypass in the OFF position.

6.8.6.12 * Does the PEEP return to ≤ 3 cm H_2O? ___(Y)

6.8.6.13 Adjust the absorber PEEP valve counterclockwise to its minimum position.

6.8.6.14 Does the PEEP return to ≤ 3 cm H_2O? ___(Y)

6.8.6.15 Close the O_2 flow control valve.

6.8.6.16 Remove the test equipment and reconnect the pilot line to the absorber.

* These items apply only to machines with a PEEP by-pass.

6.8.7 Bain Circuit Adapter - If applicable

6.8.7.1 Close the Bain Circuit APL valve by turning the knob fully clockwise.

6.8.7.2 Verify the cm H_2O gauge at zero (0) and readjust if necessary.

NOTE: The small slotted screw is the zero adjust.

6.8.7.3 Insert the O_2 sensor plug into the O_2 sensor inlet on the Bain Circuit.

6.8.7.4 Attach a Breathing System Leak Device (P/N S010159) to the Breathing Bag port on the Bain Circuit.

6.8.7.5 Disconnect the pressure pilot line from the Bain Circuit and replace it with a PDM To Monitor Adapter (P/N 4115041).

6.8.7.6 Connect a test gauge to the adapter.

6.8.7.7 Occlude the expiration port on the Bain Circuit.

6.8.7.8 Apply 50cm H_2O test pressure to the Bain Circuit.

6.8.7.9 Is the pressure indicated on the cm H_2O gauge within 3 cm H_2O of the digital pressure meter reading? ___ (Y)

(✓) 6.8.7.10 After 30 seconds, is the test pressure 45 to 50 cm H_2O? ___ (Y)

6.8.7.11 Open the APL valve by turning the knob fully counter-clockwise.

6.8.7.12 Connect a Fresh Gas Outlet Volume Adapter (P/N S010158) between the fresh gas outlet and the Expiration port of the Bain Circuit.

6.8.7.13 Set the O_2 flow to 8 l/min.

(✓) 6.8.7.14 Is the test pressure within 0 to 3 cm H_2O? ___ (Y)

6.8.7.15 Remove the test equipment and reconnect the pilot line to the Bain Circuit.

6.9 OXYGEN ANALYZER

6.9.1 Press the CAL key.

NOTE: Make sure that the sensor has stabilized in ambient air for several minutes.

(✓) 6.9.2 After calibration is completed, is the O_2 concentration 21 %? ___(Y)

6.9.3 The warning message INSP O_2 LOW shall appear on the central alarm display, and a continuous alarm shall sound.

6.9.4 Press the Alarm Silence key and verify the audio alarm is silenced.

6.9.5 Place the Oxygen sensor into the inspiratory valve dome adapter.

6.9.6 Set the AUTO/MAN selector to BAG.

6.9.7 Close the APL valve.

6.9.8 Attach a 22 mm hose (P/N 9995132) to the inspiratory valve.

6.9.9 Attach a Breathing System Leak Test Device (P/N S010159) to the bag mount.

6.9.10 Press the O_2 Flush.

6.9.11 After 10 seconds, is the O_2 concentration 90 to 100 % O_2? ___ (Y)

6.9.12 Release the O_2 Flush, does the flow cease immediately? ___ (Y)

6.9.13 Set the Oxygen flow to 10 l/min.

(✓) 6.9.14 After 1 minute, is the O_2 concentration 97 to 100%? ___ (Y)

6.10 FLOWMETERS CONCENTRATIONS

(✓) 6.10.1 Oxygen Flowmeter

6.10.1.1 Is it possible to adjust the flow of Oxygen over the full range of the flowmeters? ___ (Y)

6.10.1.2 Set the Oxygen flow to 4 l/min.

6.10.1.3 Is the correct flow control knob and label attached to the Oxygen flow control valve? ___ (Y)

(✓) 6.10.2 Oxygen-Helium Flowmeter - If applicable

6.10.2.1 Is it possible to adjust the flow of the Oxygen-Helium over the full range of the flowmeter? ___ (Y)

6.10.2.2 Set the Oxygen-Helium flow to 2 l/min.

6.10.2.3 *After the value stabilizes, is the O_2 concentration 72 to 78%? ___ (Y)

6.10.2.4 Close the Oxygen-Helium flow valve.

6.10.2.5 Is the correct flow control knob and label attached to the Oxygen-Helium flow control valve? ___ (Y)

*Oxygen-Helium specifications are given @ 25% O_2. Cylinder content deviations will affect this value. The expected concentration values can be obtained by replacing the '25' % O_2 value given for O_2-HE with the actual cylinder content as follows:

$$\frac{(2 \text{ l/min } O_2\text{-HE} \times \text{'25'}) + (4 \text{ l/min. } O_2 \times 100)}{6 \text{ l/min - Total Flow}} = \%\ O_2$$

6.10.3 This Section Intentionally Left Blank

6.10.4 This Section Intentionally Left Blank

(✓) 6.10.5 Carbon Dioxide Flowmeter - If applicable

6.10.5.1 Is it possible to adjust the flow of the Carbon Dioxide over its range of 550 ml/min.? ___ (Y)

6.10.5.2 Set the Oxygen flow to 1000 ml/min.

6.10.5.3 Set the Carbon Dioxide flow to 500 ml/min.

6.10.5.4 After the value stabilizes, is the O_2 concentration 64 to 70%? ___ (Y)

6.10.5.5 Close the Carbon Dioxide flow valve.

6.10.5.6 Readjust the Oxygen flow to 4 l/min.

6.10.5.7 Is the correct flow control knob and label attached to the Carbon Dioxide flow control valve? ___ (Y)

(✓) 6.10.6 Air Flowmeter - If applicable

6.10.6.1 If not configured with an Air Cylinder yoke, attach the Air Pipeline hose.

6.10.6.2 Is it possible to adjust the flow of the Air over the full range of the flowmeter? ___ (Y)

6.10.6.3 Set the Air flow to 2 l/min.

6.10.6.4 After the value stabilizes, is the O_2 concentration 71 to 77%? ___ (Y)

6.10.6.5 Close the Air flow control valve.

6.10.6.6 Is the correct flow control knob and label attached to the Air flow control valve? ___ (Y)

(✓) 6.10.7 Nitrous Oxide Flowmeter

6.10.7.1 Set the Nitrous Oxide flow to 2 l/min.

6.10.7.2 After the value stabilizes, is the O_2 concentration 64 to 70% ___ (Y)

6.10.7.3 Is the correct flow control knob and label attached to the Nitrous Oxide flow control valve? ___ (Y)

6.10.7.4 Is it possible to adjust the flow of Nitrous Oxide over the full range of the flowmeter? ___ (Y)

6.10.8 Oxygen Ratio Control

6.10.8.1 Open the Nitrous Oxide flow control valve to the stop position.

(✓) 6.10.8.2 After the value stabilizes, is the O_2 concentration 21 to 29%? ___(Y)

6.10.8.3 Set the Oxygen flow to 2 l/min.

(✓) 6.10.8.4 After the value stabilizes, is the O_2 concentration 21 to 29%? ___ (Y)

6.10.8.5 Set the Oxygen flow to 1000 ml/min.

(✓) 6.10.8.6 After the value stabilizes, is the O_2 concentration 21 to 29%? ___ (Y)

6.10.8.7 Reduce the O_2 flow to 500 ml/min. Verify that the N_2O flow is greater than or equal to 600 ml/min.

6.10.8.8 Close the Oxygen flow control valve.

6.10.8.9 Close the Nitrous Oxide flow control valve.

6.10.9 This Section Intentionally Left Blank

(✓) 6.10.10 Auxiliary Oxygen Flowmeter - If applicable

6.10.10.1 Connect a test pressure monitor to the Auxiliary Oxygen outlet using a PDM/Suction adapter (P/N 4115038).

6.10.10.2 Increase the pressure to 50 cm H_2O.

6.10.10.3 After 10 seconds, is the pressure within 40 to 60 cm H_2O? ___ (Y)

6.10.10.4 Remove the test gauge and adapter.

6.10.10.5 Is it possible to adjust the Auxiliary Oxygen flowmeter over the full range of the flowmeter? ___(Y)

6.10.10.6 Set the flow rate to 5 l/min.

6.10.10.7 Hold the Oxygen sensor at the flowmeter outlet.

6.10.10.8 After the value stabilizes, is the O_2 concentration within 80 to 100% ___ (Y)

6.10.10.9 Replace the Oxygen sensor into the Inspiratory valve dome.

6.10.10.10 Close the Auxiliary Oxygen flow control valve.

(✓) 6.11 HIGH PRESSURE REGULATOR - Six Month Service Interval; Due Date _____

6.11.1 N_2O Regulator

NOTE: Minimum cylinder pressure for N_2O regulator test is 600 psi.

6.11.1.1 Configure the test gauge (P/N 4114807) using a N_2O nut/stem DISS connector (P/N 4114830-004) on the hose, and N_2O DISS body connector (P/N 4114830-003) on the valve body side. If the machine is configured with CSA style fittings reverse the position of the connectors.

6.11.1.2 Connect the test fixture hose to the machine's Nitrous Oxide pipeline inlet.

6.11.1.3 Connect the Nitrous Oxide pipeline supply hose to the test fixture.

6.11.1.4 Open the Nitrous Oxide and the Oxygen cylinder valves.

6.11.1.5 Set the Oxygen and Nitrous Oxide flows to 4 l/min.

6.11.1.6 Depress the push button on the test device.

(✓) 6.11.1.7 Release the push button. After the pressure decay stabilizes, is the regulator output pressure 40 to 49 psi? ___(Y)

6.11.1.8 Remove the test fixture.

NOTE: If a pressure decrease does not occur, either the hospital's supply pressure is too low or the regulator pressure is set too high.

6.11.2 Air Regulator - If applicable

NOTE: Minimum cylinder pressure for Air regulator test is 1000 psi.

6.11.2.1 Configure the test gauge (P/N 4114807) using an Air nut/ stem DISS connector (P/N 4114830-002) on the hose and a DISS body connector (P/N 4114830-001) on the valve body side. If the machine is configured with CSA style fittings reverse the position of the connectors.

6.11.2.2 Connect the test fixture hose to the machine's air pipeline inlet.

6.11.2.3 Connect the Air pipeline supply hose to the test fixture.

6.11.2.4 Set the Air flow to 4 l/min.

6.11.2.5 Depress the push button on the test device.

(✓) 6.11.2.6 Release the push button. After the pressure decay stabilizes, is the regulator output pressure within tolerance given in the following table? ___ (Y)

NOTE: If a pressure decrease does not occur, either the hospital's supply pressure is too low or the regulator pressure is set too high.

Cylinder Pressure psi	USA Compensated Regulator output tolerances	ISO Compensated Regulator output tolerances
2000	38 to 44	41 to 47
1800	39 to 45	42 to 48
1600	40 to 46	43 to 49
1400	41 to 47	44 to 50
1200	42 to 48	45 to 51
1000	43 to 49	46 to 52

6.11.2.7 Remove the test fixture.

6.11.3 O_2 Regulator

NOTE: Minimum cylinder pressure for O_2 regulator test is 1000 psi.

6.11.3.1 Configure a test gauge (P/N 4114807) using an O_2 nut/stem DISS connector (P/N 4114830-006) on the hose and an O_2 DISS body connector (P/N 4114830-005) on the valve body side. If the machine is configured with CSA style fittings reverse the position of the connectors.

6.11.3.2 Connect the test fixture hose to the machine's Oxygen pipeline inlet.

6.11.3.3 Connect the Oxygen pipeline supply hose to the test fixture.

6.11.3.4 Set the Oxygen flow to 4 l/min.

6.11.3.5 Depress the push button on the test device.

(✓) 6.11.3.6 Release the push button. After the pressure decay stabilizes, is the regulator output pressure within the tolerance given in the following table? ___ (Y)

NOTE: If a pressure decrease does not occur, either the hospital's supply pressure is too low or the regulator pressure is set too high.

Cylinder Pressure psi	USA Compensated Regulator output tolerances	ISO Compensated Regulator output tolerances
2000	38 to 44	41 to 47
1800	39 to 45	42 to 48
1600	40 to 46	43 to 49
1400	41 to 47	44 to 50
1200	42 to 48	45 to 51
1000	43 to 49	46 to 52

(✓) 6.12 LOW O_2 SUPPLY - Six Month Service Interval; Due Date _____

6.12.1 Close the Oxygen cylinder valve and drain all Oxygen pressure.

6.12.2 Depress the push button on the test device.

6.12.3 Adjust the Oxygen flow to 500 ml/min.

6.12.4 Release the test device push button.

6.12.5 Is the pressure on the test gauge when the LO O_2 SUPPLY message appears within 34 to 40 psi? ___ (Y)

6.12.6 Remove the test equipment.

6.13 OXYGEN SUPPLY FAILURE PROTECTION

6.13.1 Connect all pipeline supplies.

6.13.2 Close the Oxygen flow control valve if applicable.

(✓) 6.13.3 *Is the flow of Oxygen 150 to 200ml/min.? ___ (Y)

6.13.4 Open the Nitrous Oxide flow control valve.

(✓) 6.13.5 *Is the flow of Nitrous Oxide 375 to 750 ml/min.? ___ (Y)

6.13.6 Adjust the Oxygen, Nitrous Oxide and additional gas flow to 4 l/min. Set Carbon Dioxide Flow to 500 ml/min., if applicable.

6.13.7 Disconnect the Oxygen pipeline supply and close the Oxygen cylinder valve.

(✓) 6.13.8 Do all fresh gas flows cease when the Oxygen pressure is depleted? ___(Y)

6.13.9 Reconnect the Oxygen pipeline supply.

6.13.10 Close all cylinder valves and then disconnect the Nitrous Oxide pipeline supply, and air pipeline if applicable.

6.13.11 Drain the cylinder contents then reconnect the pipeline supplies.

6.13.12 Close all flow control valves.

* Nitrous Oxide Bypass flow and Minimum Oxygen flow specifications are given @ 50 psi. Pipeline pressure deviations may affect these tests.

6.14 PRESSURE MONITOR

6.14.1 Disconnect the breathing pressure sensor line from the absorber.

6.14.2 Connect a PDM Adapter (P/N 4115043) and test pressure gauge to the breathing pressure sensor line.

6.14.3 Adjust the test pressure to 0 cm H_2O.

6.14.4 Simultaneously set AUTO/BAG valve to AUTO, (Vent ON) and start a stopwatch.

(✓) 6.14.5 Does the APNEA PRESSURE appear on the alarm display as a CAUTION within 13 to 17 seconds? ___ (Y)

(✓) 6.14.6 Increase the test pressure slowly. Does the APNEA PRRESSURE alarm deactivate within 10 to 14 cm H_2O? ___ (Y)

6.14.7 First decrease the pressure then increase the test pressure above the threshold line shown on the display, and begin timing with a stopwatch.

(✓) 6.14.8 Does the CONTINUOUS PRES appear as a warning within 13 to 17 seconds? ___ (Y)

(✓) 6.14.9 Decrease the pressure slowly. Does the CONTINUOUS PRES alarm deactivate within 10 to 14 cm H_2O? ___ (Y)

(✓) 6.14.10 Increase the test pressure slowly. Does a VENT PRESS HI activate as a warning alarm within 47 to 53 cm H_2O? ___ (Y)

(✓) 6.14.11 Create a sub-atmospheric test pressure slowly. Does the SUB ATM PRES warning alarm activate within -7 to -13 cm H_2O? ___ (Y)

6.14.12 Set the AUTO/BAG valve to BAG, (Vent off).

6.14.13 Open APL valve.

6.14.14 Remove the test equipment and reconnect the breathing pressure sensor line to the absorber.

6.15 VENTILATOR

NOTE: Readjustment of inspiratory flow to limit the inspiratory plateau may be required to reduce erratic tidal volumes and breath rates caused by artifact volumes.

6.15.1 Remove the bellows hose and the scavenger hose at the ventilator relief valve. Remove the bellows sub-assembly and remove bellows.

6.15.2 Visually inspect the bellows for deterioration particularly at its seams and corrugations.

6.15.3 Verify the presence of it's sealing O-ring and reassemble the components.

6.15.4 Turn on the ventilator on using the ON/OFF knob.

6.15.5 If applicable, does the FAULT indicator turn on? (Y)

6.15.6 Set the AUTO/MAN selector switch to AUTO.

6.15.7 Does the FAULT indicator turn off? (Y)

6.15.8 Set the FREQUENCY to 10 BPM.

(✓) 6.15.9 Press and hold the EXTENDED RANGE switch and set the I:E ratio to 2:1. Using a stopwatch, time the extended I:E ratio. Is the inspiratory time within 3.6 to 4.4 seconds and the expiratory time between 1.8 to 2.2 seconds? ___ (Y)

(✓) 6.15.10 Set the I:E RATIO to 1:2. Using a stopwatch, time the I:E ratio. Is the inspiratory time between 1.8 to 2.2 seconds and the expiratory time within 3.6 to 4.4 seconds? ___ (Y)

6.15.11 Adjust the Oxygen flow to 500 ml/min.

6.15.12 Set the Tidal Volume to 1200, or if testing an external pediatric bellows set the tidal volume to approximately 300 ml.

6.15.13 Attach a patient circuit to the absorber system.

6.15.14 Set the pressure limit control to MAX.

6.15.15 Adjust the Inspiratory Flow to the bottom of the LOW zone.

6.15.16 Occlude the Y-piece.

6.15.17 Press the O_2 Flush momentarily to inflate the bellows.

6.15.18 Adjust the Inspiratory Flow until a peak pressure of 80 cm H_2O is achieved.

(✓) 6.15.19 If applicable, set the Pressure Limit Control to within the 30 range. Readjust within the band as necessary to achieve proper value. Is the peak pressure at the 30 range within 27 to 33 cm H_2O? ___ (Y)

(✓) 6.15.20 Set the Pressure Limit Control to the MIN position. Is the peak pressure at the MIN range 0 to 15 cm H_2O? ___ (Y) Return the Pressure Limit control to MAX.

6.15.21 Loosen the expiratory valve dome, or if equipped with an ultrasonic flow sensor, open the Y-piece and disconnect the hose attached to the exhalation valve and blow into it.

(✓) 6.15.22 Does the Reverse Flow message appear on the display? ___ (Y)

6.15.23 Tighten the expiratory valve dome if applicable, or if equipped with an ultrasonic flow sensor reconnect the hose between the expiratory valve and the flow sensor.

6.15.24 Insert a test minute volumeter in between absorber dome and Spiromed, or exhalation valve and absorber dome if equipped with an ultrasonic flow sensor.

6.15.25 Open the Y-piece.

6.15.26 Turn the ventilator off and press the ALL STBY key to clear alarms.

6.15.27 Turn the ventilator on and start a stop watch.

(✓) 6.15.28 Does APNEA-VOLUME appear as a Caution within 13 to 17 seconds? ___ (Y)

6.15.29 Attach a 3 liter breathing bag to the Y-piece.

NOTE: Bag should be placed on a flat horizontal surface to reduce artifact volume.

6.15.30 Press the O_2 Flush momentarily to inflate the bellows.

6.15.31 Set the Inspiratory Flow to the MED and readjust as necessary to fully collapse the bellows.

(✓) 6.15.32 Observe the operation of each unidirectional valve disc at eye level. Does the inspiratory valve disc raise only during the inspiration phase, and the expiratory valve raise only during the exhalation phase? ___(Y)

(✓) 6.15.33 Is the tidal volume on the volume monitor and on the test volumeter within 20 % of each other? ___ (Y)

6.15.34 Does the volume monitor display 10 BPM? ___ (Y)

6.15.35 Does the display correctly track the Breathing Pressure waveform? ___ (Y)

6.16 BELLOWS ADULT - If applicable

(✓) 6.16.1 Is the tidal volume indicated on the test volumeter 960 to1440 ml? ___(Y)

(✓) 6.16.2 Does the bellows remain fully inflated during the expiratory pause phase? ___ (Y)

6.16.3 Remove the ventilator hose from the VENTILATOR HOSE terminal.

6.16.4 Attach a test terminal to the bellows assembly ventilator hose terminal.

6.16.5 Connect a 0-250 ml/min. flowmeter (P/N S000081) to the test terminal.

6.16.6 Set the FREQUENCY to 1 BPM.

(✓) 6.16.7 Is the drive gas leakage indicated during the inspiratory phase 0 to 50 ml? ___(Y)

6.16.8 Remove the test equipment from the ventilator hose terminal and reconnect the ventilator hose to the VENTILATOR HOSE terminal.

6.16.9 Set the FREQUENCY to 10 BPM.

6.16.10 Adjust the O_2 flow to 10 l/min.

6.16.11 Adjust the Tidal Volume to maximum.

6.16.12 Press the O_2 Flush momentarily to inflate the bellows.

6.16.13 Adjust the INSPIRATORY FLOW to fully compress the bellows.

(✓) 6.16.14 Is the Tidal Volume on the test volumeter greater than 1400 ml? ___(Y)

(✓) 6.16.15 Is the PEEP value displayed on the monitor 0 to 3 cm H_2O? ___(Y)

6.16.16 Remove the breathing bag from the Y-piece and replace it with a test lung.

6.16.17 Adjust the Oxygen flow to 300 ml/min.

6.16.18 Adjust the Tidal Volume to 200 ml.

6.16.19 Does the bellows stop adjust smoothly and engage properly? ___ (Y)

6.16.20 Adjust the INSPIRATORY FLOW to fully compress the bellows.

(✓) 6.16.21 Is the Tidal Volume on the test volumeter 125 to 250 ml? ___(Y)

6.16.22 Close the Oxygen flow control valve.

6.16.23 Remove the test lung, set the AUTO/BAG selector valve to BAG.

6.16.24 Press the Alarms All Standby key.

6.17 BELLOWS PEDIATRIC EXTERNAL - If applicable

6.17.1 Adjust the fine flow control of the pediatric bellows attachment fully clockwise.

6.17.2 Remove the breathing bag from the Y-piece and replace it with a test lung (P/N 4115128).

6.17.3 Press the O_2 Flush momentarily to inflate the bellows.

(✓) 6.17.4 Does the bellows remain fully inflated during the expiratory pause phase? ___ (Y)

6.17.5 Set the ventilator frequency to 20 BPM.

6.17.6 Adjust the O2 flow to 3 l/min.

(✓) 6.17.7 Is the tidal volume on the test volumeter greater than 250 ml? ___(Y)

6.17.8 Adjust the tidal volume to the 100 ml mark on the pediatric bellows assembly.

(✓) 6.17.9 Is the tidal volume on the test volumeter within 65 to 135 ml? ___ (Y)

6.17.10 Verify that with the Pediatric Bellows Fine Flow Control turned fully counter-clockwise the bellows does not collapse during inspiration. Readjust the knob to the fully clockwise position.

6.17.11 Adjust the O2 flow to 10 l/min.

(✓) 6.17.12 Is the PEEP displayed on the monitor 0 to 3 cm H2O? ___ (Y)

6.17.13 Close the Oxygen flow control valve.

6.17.14 Remove the ventilator hose from the VENTILATOR HOSE terminal.

6.17.15 Attach a test terminal (P/N 4104389) to the bellows assembly ventilator hose terminal.

6.17.16 Connect a 0-250 ml/min. flowmeter (P/N S000081) to the test terminal.

6.17.17 Set the FREQUENCY to 1 BPM.

6.17.18 Set the I:E RATIO to 1:1.

6.17.19 Set the Inspiratory Flow to MAX.

(✓) 6.17.20 Is the drive gas leakage indicated during the inspiratory phase 0 to 50 ml/min? ___ (Y)

6.17.21 Remove the test equipment and reattach the ventilator hose to the VENTILATOR HOSE terminal.

6.17.22 Set AUTO/BAG valve to BAG.

6.17.23 Press the Alarms All Standby key.

6.18 BELLOWS PEDIATRIC INTERNAL - If applicable

6.18.1 Remove the breathing bag from the Y-piece and replace it with a test lung (P/N 4115128).

6.18.2 Press the O2 Flush momentarily to inflate the bellows.

(✓) 6.18.3 Does the bellows remain fully inflated during the expiratory pause phase? ___ (Y)

6.18.4 Set the ventilator frequency to 20 BPM.

6.18.5 Set the Oxygen flow to 3 liters.

(✓) 6.18.6 Is the tidal volume on the test volumeter greater than 250 ml? ___ (Y)

6.18.7 Adjust the inspiratory flow and Pressure limit control if applicable control until the bellows collapses to the 100 ml mark on the pediatric bellows assembly.

(✓) 6.18.8 Is the tidal volume on the test volumeter 65 to 35 ml? ___ (Y)

6.18.9 Adjust the Oxygen flow to 10 l/min.

(✓) 6.18.10 Is the PEEP displayed on the monitor within 0 to 3 cm H_2O? ___ (Y)

6.18.11 Close the Oxygen flow control valve.

6.18.12 Remove the ventilator hose from the ventilator hose terminal.

6.18.13 Attach a test terminal to the bellows assembly ventilator hose terminal.

6.18.14 Connect a flowmeter test stand (P/N S000081) to the test terminal.

6.18.15 Set the frequency to 1 BPM.

6.18.16 Set the I:E RATIO to 1:1.

(✓) 6.18.17 Is the flow indicated during the inspiratory phase less than 50 ml? ___ (Y)

6.18.18 Remove the test equipment and reattach the ventilator hose to the VENTILATOR HOSE terminal.

6.18.19 Return pressure limit control to MAX.

6.18.20 Set AUTO/BAG valve to BAG.

6.18.21 Press the Alarms All Standby key.

(✓) 6.19 OPEN RESERVOIR SCAVENGER 6-Month Service Interval; Due Date _____, If applicable

NOTE: If the ambient air in the local environment contains a significant amount of dust and lint, the cleaning frequency must be increased to compensate for these conditions.

6.19.1 OPEN RESERVOIR SCAVENGER CLEANING

6.19.1.1 Remove the scavenger hoses and drain all accumulated moisture. Inspect all scavenger hoses for deterioration and replace as needed.

6.19.1.2 Disconnect the hospital vacuum source from the scavenger.

6.19.1.3 Cleaning procedure for assemblies with 2 large relief ports. If configured with many small vent ports skip to step.

1. Remove the four screws securing the reservoir tube to the main block. Examine the two sealing O-rings and replace as necessary.
2. Remove the screws securing the access panel at the bottom of the scavenger canister.
3. Remove and inspect the silencer; replace if needed.
4. Clean the reservoir tube with compressed air if necessary.
5. Remove the flowmeter from its housing by turning it counterclockwise.
6. Inspect the tube and clean with compressed air if needed.
7. Apply vacuum to the port at top of the flowmeter housing.

8. Go to step 6.19.2.5.

6.19.1.4 Cleaning procedure for assemblies with many small vent ports.

1. Remove the scavenger mounting screws.
2. Remove the scavenger flow control needle valve assembly. Inspect the needle valve and seat for lint or dust accumulation. Clean with compressed air if necessary.
3. Remove the hardware securing the flowmeter. Remove the brass retainer at the bottom of the assembly. Inspect the for lint or dust accumulation. Clean with compressed air if necessary.
4. Unthread the reservoir canister from the body.
5. Remove the hardware securing the tube assembly to the block. Inspect for lint or dust accumulation. Clean with compressed air if necessary and replace O-rings if necessary.
6. Probe all gas passages of the block to ensure there are no occlusions. Clean with compressed air if necessary.

6.19.1.5 Reassemble the scavenger assembly, attach the scavenger hose and reactivate the vacuum source.

6.19.2 OPEN RESERVOIR PRESSURE TESTING

6.19.2.1 Activate the Scavenger vacuum supply.

6.19.2.2 Turn the scavenger needle valve fully clockwise (closed).

6.19.2.3 Uncap the hose barb adapter at the rear of the scavenger and connect a test pressure monitor to the hose barb on the adapter using a PDM/Suction Adapter (P/N 4115038). If the scavenger does not contain a hose barb adapter install a scavenger adapter (P/N 4108114) between the 19-mm hose terminal on the scavenger and the scavenger hose.

6.19.2.4 Interconnect the inspiratory and expiratory valves or expiratory port on the ultrasonic flow sensor, if applicable with a 22-mm hose.

6.19.2.5 Attach a Breathing System Leak Test Device (P/N S010159) to the bag mount.

6.19.2.6 Set the AUTO/BAG valve to the BAG position.

6.19.2.7 Open the APL valve.

6.19.2.8 Set the Oxygen flow on the anesthesia machine to 8 l/min.

6.19.2.9 The test pressure gauge shall indicate a pressure of less than 1.0 cm H_2O.

6.19.2.10 Close all flow control valves on the anesthesia machine.

6.19.2.11 Adjust the scavenger needle valve until the flowmeter indicates between the white lines.

6.19.2.12 What is the pressure on the test gauge? ___ cm H_2O (0 to -0.5)

6.19.2.13 Remove the test equipment, re-cap the scavenger adapter port or remove the scavenger adapter and reconnect the scavenger hose.

(✓) 6.20 A/C SCAVENGER - 6 Month Service Interval; Due Date _____, If applicable

NOTE: If the ambient air in the local environment contains a significant amount of dust and lint, the cleaning frequency must be increased to compensate for these conditions.

6.20.1 A/C SCAVENGER CLEANING

6.20.1.1 Remove the scavenger hoses and drain any accumulated moisture. Inspect the hoses for deterioration, then reinstall or replace it if needed.

6.20.1.2 Remove the safety relief valve housing by unscrewing it in a counter-clockwise direction.

6.20.1.3 Inspect the O-ring and replace it if needed.

6.20.1.4 Remove the safety relief valve from its housing by twisting it out in a counter-clockwise direction. The tips of needle nose pliers can be used to turn the valve. Be careful not to damage the valve's fragile disk.

6.20.1.5 Remove any accumulated lint or dust from the valve with a soft brush. The valve may be further cleaned with a low flow of Air or Oxygen. The scavenger body can be cleaned with a moist cloth.

6.20.1.6 Reinstall the valve into the housing, making sure that it is threaded all the way into the housing and that the plastic washer is properly seated on its upper surface.

6.20.1.7 Reinstall the valve housing onto the scavenger body, making sure that the O-ring is properly seated.

6.20.2 AC SCAVENGER TESTING

6.20.2.1 Set the AUTO/BAG valve to the BAG position.

6.20.2.2 Open the APL valve.

6.20.2.3 Occlude the bag mount connector with a Breathing System Leak Test Device (P/N S010159).

6.20.2.4 Interconnect the inspiratory and expiratory valves or expiratory port on the ultrasonic flow sensor, if applicable with a 22-mm hose.

6.20.2.5 Set the Oxygen flow on the anesthesia machine to 8 l/min.

6.20.2.6 Install a scavenger adapter (P/N 4108114) between the 19-mm hose terminal on the scavenger and the scavenger hose.

6.20.2.7 Connect a test pressure monitor to the hose barb on the adapter using a PDM/Suction Adapter (P/N 4115038).

6.20.2.8 Remove the transfer hose from the bottom of the scavenger and occlude this port.

6.20.2.9 What is the pressure on the test gauge? ___ cm H_2O (5 to 10)

6.20.2.10 Remove the test equipment and reconnect the scavenger hose and the transfer hose.

6.20.2.11 Close the Oxygen flow control valve.

(✓) 6.21 BAG SCAVENGER - Six Month Service Interval; Due Date _____, If applicable

NOTE: If the ambient air in the local environment contains a significant amount of dust and lint, the cleaning frequency must be increased to compensate for these conditions.

6.21.1 BAG SCAVENGER CLEANING

6.21.1.1 Remove the scavenger hoses and drain any accumulated moisture. Inspect the hoses for deterioration, then reinstall or replace as needed.

6.21.1.2 Remove the reservoir bag and drain any accumulated moisture and inspect it for deterioration, then reinstall or replace as needed. All under sized or single use bags must be replaced with 5-liter reusable style reservoir bag.

6.21.1.3 Remove the plastic valve cover on the front surface of the scavenger body by turning it in a counter-clockwise direction.

6.21.1.4 Remove the valve and washer from the scavenger body by turning it counter-clockwise. A needle-nose pliers may be used to turn the valve, but use care not to damage the valve's fragile disk.

6.21.1.5 Brush any accumulated lint or dust off the valve with a soft brush. The valve may be further cleaned with a low flow of clean Air or Oxygen.

6.21.1.6 Reinstall the plastic washer and valve into the scavenger body. Replace the valve cover.

6.21.1.7 Unscrew the valve housing on the left side of the scavenger body by turning its fitting counter-clockwise with a wrench.

6.21.1.8 Unscrew the valve from the housing by turning it in a counterclockwise direction.

6.21.1.9 Brush any accumulated lint or dust off the valve with a soft brush. The valve may be further cleaned with a low flow of clean Air or Oxygen.

6.21.1.10 Reinstall the valve in the housing, and then reinstall the housing into the scavenger body.

NOTE: This valve does not require washers or O-rings.

6.21.1.11 Remove the valve housing on the right side of the scavenger body by turning it counter-clockwise.

6.21.1.12 Inspect the rubber O-ring and replace if worn.

6.21.1.13 Remove the valve from the housing by turning it counterclockwise. A needle-nose pliers may be used to turn the valve, but use care not to damage the valve's fragile disk.

6.21.1.14 Brush any accumulated lint or dust off the valve with a soft brush. The valve may be further cleaned with a low flow of clean Air or Oxygen.

6.21.1.15 Reinstall the valve and plastic washer into the housing.

6.21.1.16 Reinstall the valve housing onto the scavenger body, making sure that the O-ring is properly seated.

6.21.2 BAG SCAVENGER TESTING

6.21.2.1 Activate the Scavenger vacuum supply.

6.21.2.2 Turn the scavenger needle valve fully clockwise (closed).

6.21.2.3 Install a scavenger adapter (P/N 4108114) between the 19-mm hose terminal on the scavenger and the scavenger hose.

6.21.2.4 Connect a test pressure monitor to the hose barb on the adapter using a PDM/Suction Adapter (P/N 4115038).

6.21.2.5 Set the AUTO/MAN valve to the BAG position.

6.21.2.6 Connect a 22mm breathing hose between the absorber's inspiratory valve and expiratory valve or expiratory hose terminal on the ultrasonic flow sensor, if applicable.

6.21.2.7 Open the APL valve.

6.21.2.8 Occlude the bag mount connector.

6.21.2.9 Press the O_2 Flush button to inflate the scavenger reservoir bag.

6.21.2.10 Open the Oxygen flow control valve to 8 l/min.

6.21.2.11 Does the reading on the test gauge indicate a pressure less than or equal to 10.0 cm H_2O? ___(Y)

6.21.2.12 Adjust the scavenger needle valve to allow typical suction through the scavenger.

6.21.2.13 Close all flow control valves on the machine.

6.21.2.14 Does the gauge indicate a pressure of less than or equal to -1.0 cm H_2O? ___(Y)

6.21.2.15 Remove the test equipment and reconnect the scavenger hose.

6.21.2.16 Close the Oxygen flow control valve.

(✓) 6.22 SUCTION REGULATOR - 6-month Service Interval; Due Date _____, If applicable

6.22.1 Set the vacuum on/off valve to the ON position.

6.22.2 Set the regulator to indicate 250 mm Hg.

6.22.3 Connect a digital pressure meter to the collecting inlet stem of the suction bottle.

6.22.4 Set the digital pressure meter to the mm Hg scale.

6.22.5 Is the vacuum indicated on the digital pressure meter within 200 to 300 mm Hg? ___ (Y)

6.22.6 Set the vacuum on/off valve to the OFF (vertical) position.

6.22.7 Turn the vacuum control knob fully counter-clockwise.

(✓) 6.23 MANUAL SPHYGMOMANOMETER - 6-month Service Interval; Due Date _____, If applicable

6.23.1 Insert the male Luer fitting of the Sphygmomanometer squeeze bulb hose assembly into the female Luer fitting labeled BP BULB on the front of the machine.

6.23.2 Insert an NIBP-Luer Test Adapter (P/N 4116111-001) inline between the blood pressure cuff and the extension hose.

6.23.3 Wrap the blood pressure cuff around an “E” cylinder.

6.23.4 Hand-pump the squeeze bulb until pressure of 200 mm Hg is indicated on the test gauge and start a stop watch.

6.23.5 Does the Sphygmomanometer indicate within 180 to 220 mm Hg? ___ (Y).

6.23.6 After thirty (30) seconds, is the pressure on the Sphygmomanometer gauge within 190 to 200 mm Hg? ___ (Y)

6.23.7 Remove test equipment.

6.23.8 Remove the blood pressure cuff from the “E” cylinder.

6.23.9 Does the Sphygmomanometer indicate within the band? ___ (Y)

6.24 FINAL TESTS

(✓) 6.24.1 Is the machine’s Operator’s Instruction manual in close proximity of the machine? ___ (Y)

6.24.2 Does the table lamp work properly if fitted? ___ (Y)

6.24.3 Verify all cylinder pressure gauges indicate zero.

6.24.4 Verify the pipeline hoses are connected to the hospital pipeline.

6.24.5 Verify the APL valve knob is turned completely counterclockwise (fully open).

6.24.6 Place the AUTO/BAG selector in the BAG position.

6.24.7 Verify the ventilator hose is connected between the Auto/Man valve and Ventilator hose terminal.

6.24.8 Verify the pressure pilot line is connected between the machine interface and absorber.

6.24.9 Verify the Oxygen sensor is removed from the inspriatory valve dome adapter.

6.24.10 Verify the inspriatory valve dome is plugged.

6.24.11 Unplug the machine's AC power cord. Is the "AC PWR FAIL" LED lighted? ___(Y) Press and hold the "BATTERY TEST" button. Is green Battery Test LED lighted? ___ (Y)

6.24.12 Plug the power cord back into the original AC receptacle.

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DrägerService is a division of
Draeger Medical, Inc.
3122 Commerce Drive
Telford, PA 18969
Tel: (215) 721-5402
(800) 543-5047
Fax: (215) 721-5784
Web: www.draegermedical.com
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